The relationship between the UPPS-P impulsive personality traits and substance use psychotherapy outcomes: A meta-analysis

Alexandra R. Hershberger, Miji Um, Melissa A. Cyders

Department of Psychology, Indiana University – Purdue University, Indianapolis, 402 North Blackford Street, Indianapolis, Indiana, 46202

Correspondence:

Alexandra R. Hershberger

402 North Blackford St.

LD 126W, Indianapolis, Indiana, 46202

Phone: 1-317-274-6949

alermart@iupui.edu

Highlights

- UPPS-P model used to examine impulsive personality in substance use disorder (SUD) treatment
- High negative urgency and lack of premeditation related to poorer treatment outcome
- Small decreases in sensation seeking and negative urgency through treatment
- Great need to integrate impulsive personality into substance use treatment

This is the author's manuscript of the article published in final edited form as:
Hershberger, A. R., Um, M., & Cyders, M. A. (2017). The relationship between the UPPS-P impulsive personality traits and substance use psychotherapy outcomes: A meta-analysis. Drug and Alcohol Dependence. https://doi.org/10.1016/j.drugalcdep.2017.05.032

Abstract

Background: Although impulsive personality traits have been well implicated in substance use disorder (SUD) risk, little work has established how specific impulsive personality traits influence and are influenced by SUD psychotherapy outcomes. The purpose of this meta-analysis was to quantitatively review existing work to examine 1) how impulsive personality traits affect SUD psychotherapy outcomes and 2) reductions in impulsive personality traits during SUD psychotherapy.

Methods: Studies were identified by conducting a comprehensive review of the literature.

Results: For aim one (k =6), significant effects were found for lack of premeditation (g=0.60, SE=0.30, 95% CI 0.01 to 1.20; z=1.99, p = .05) and negative urgency (g=0.55, SE=0.17, 95% CI 0.22 to 0.88, z=3.30, p=.001), with trait scores related to poorer SUD psychotherapy outcomes. For aim two (k = 10), decreases in sensation seeking (g=-0.10, SE=0.05, 95% CI -0.20 to 0.004; z=-1.88, p=.02) and negative urgency (g=-0.25, SE=0.14, 95% CI -0.53 to 0.03; z=-1.75, p=.03) during SUD psychotherapy were significant.

Conclusions: Overall, our quantitative synthesis suggests that lack of premeditation and negative urgency are related to poorer SUD psychotherapy outcomes. Although negative urgency and sensation seeking are decreasing during SUD psychotherapy, the magnitude of the change is quite small. Overall, we suggest that the measurement and targeting of impulsive personality traits in psychotherapy has strong potential to improve clinical outcomes across SUDs and a wide range of clinical problems and disorders.

Keywords: impulsive, personality, substance use, treatment, psychotherapy

1. Introduction

Substance use disorders (SUDs) are a major public health concern, with approximately one out of ten deaths in individuals aged 20-64 attributable to alcohol use (CDC, 2013). In addition, there have been substantial increases in drug overdoses of heroin (600% increase) and cocaine (42% increase; CDC, 2015) since 2001. There are evidence-based treatments for SUDs; however, over 50% of individuals continue to meet criteria for a SUD at follow-up (one to five years; White, 2012). Although research has established that impulsive personality traits are strongly related to SUD risk (e.g., Coskunpinar et al., 2013; VanderVeen et al., 2016), little work has begun to integrate this risk factor into treatment design and evaluation. The goals of the current review were to examine 1) how impulsive personality traits affect SUD psychotherapy treatment outcomes and 2) how impulsive personality traits might decrease during SUD psychotherapy.

Research indicates that impulsivity is composed of 1) behavioral impulsivity and 2) impulsive personality (Cyders and Coskunpinar, 2011). Both behavioral and personality models of impulsivity are related to substance use (Sharma et al., 2014); however, meta-analytic findings indicate the strength of the relationship between these two constructs is small (r=0.10; Cyders and Coskunpinar, 2011), suggesting they are better conceptualized as different constructs. We examined only impulsive personality, using the UPPS-P impulsive personality model (Lynam et al., 2007). We chose to focus our review solely on impulsive personality because 1) previous work has addressed how behavioral impulsivity influences SUD psychotherapy (e.g., Stevens et

al., 2014) and 2) impulsive personality has been well established as a risk factor for the development of SUDs (e.g., Littlefield et al., 2012; Guller et al., 2015), as well as the continuation of substance use (e.g., Littlefield et al., 2009).

We conceptualized impulsive personality using the UPPS-P (Lynam et al., 2007), which assesses impulsive personality through five separate, though related, impulsive personality traits: 1) *negative urgency*, or a disposition to act rashly in response to negative affect, 2) *positive urgency*, or a disposition to act rashly in response to positive affect, 3) *lack of perseverance*, or difficulties seeing tasks through completion, 4) *lack of premeditation*, or acting before thinking, and 5) *sensation seeking*, or seeking out novel and/or exciting experiences.

Separable UPPS-P impulsive personality traits are also differentially related to varying substance use outcomes. For example, negative and positive urgency are most highly related to problematic alcohol use, negative urgency and lack of premeditation are most highly related to alcohol dependence, and lack of perseverance is most highly related to drinking quantity (Coskunpinar et al., 2013). Overall, higher impulsive personality trait scores correspond to higher quantities of substance use (e.g., Littlefield and Sher, 2010). Importantly, research indicates that impulsive personality developmentally precedes substance use (e.g., Littlefield et al., 2012; Guller et al., 2015) and is likely a prime risk factor for SUDs.

Recently, researchers have proposed that impulsive personality traits do not just serve as a risk factor for the development of SUDs, but that impulsive personality traits are related to poorer SUD treatment outcomes as well (Loree et al., 2015). Some initial research has found that higher impulsive personality is related to less substance use change pre- to post-treatment (Cimini et al., 2009); however, other research has failed to find a significant relationship between

impulsive personality and alcohol use relapse (Müller et al., 2008; Czapla et al., 2016) or has found lower rates of relapse in individuals higher in impulsive personality (Papachristou et al., 2014). We propose that impulsive personality traits serve as a risk factor for poor SUD treatment outcomes (see Figure 1) because impulsive personality traits influence substance use both directly and indirectly, and if they are unchanged in treatment, this leaves one at higher risk for poor treatment outcomes or relapse.

A growing body of literature aims to discern if current SUD psychotherapy is related to decreases in impulsive personality traits; however, there are discrepant findings, with some research finding significant decreases in impulsive personality trait scores pre- to post-treatment (Irwin and Stoner, 1991) and others failing to find significant changes (Aklin et al., 2009; Dib-Goncalves et al., 2014).

There is evidence that personality can change through treatment (e.g., Zapolski and Smith, 2016); however, many SUD psychotherapies target factors that mediate the relationship between impulsive personality traits and substance use (e.g., coping motives, benefit perceptions, and self-efficacy; e.g., Kiluk et al., 2010; Witkiewitz et al., 2012; Magill et al., 2015) and few directly target impulsive personality traits (e.g., Zapolski and Smith, 2016). Changing mechanisms, but not the more distal factor of impulsive personality, leaves one at risk for poorer outcomes through a number of other mechanisms of impulsive personality's influence on substance use. Taken together, it appears that SUD psychotherapy tends to target the more proximal factors of substance use (e.g., self-efficacy, coping), while little attention has been given to more distal, likely underlying, factors, such as impulsive personality traits.

Importantly, much of this previous work has been done in small samples, as treatment studies are expensive and highly time consuming, making the robustness of any one study finding of questionable reliability. Therefore, we quantitatively reviewed and synthesized this existing work in order to produce a more robust determination of how impulsive personality traits might influence, and be influenced by, SUD psychotherapy. This review allows for more confidence in the findings of this program of research than would be allowed by reviewing each study in isolation. The main aims of the present meta-analysis are to examine 1) how UPPS-P traits affect SUD psychotherapy outcomes and 2) reductions in UPPS-P traits during SUD psychotherapy.

2.0 Methods

2.1 Literature Search

Articles were identified through: 1) Key word searches in *Medline, PsychInfo, EMBase* and *PsychArticles,* based on an exhaustive combination of the following keyword groups: a) *impuls*, sensation seeking, urgen*, persever** **or** *premeditat*,* b) *substance, alcohol, drinking, heroin, opi*, *amphetamine, cocaine, stimulant, cannabis,* **or** *marijuana,* and c) *treatment;* 2) e-mail alerts; 3) reference sections of identified articles; 4) forward searches of identified articles, and 5) poster abstracts from the 2016 Research Society on Alcoholism Annual Meeting and Conference. Study authors were contacted in cases of missing information.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria for both study aims were: 1) report findings of an SUD psychotherapy treatment led by a professional (i.e., the treatment of SUD through psychological intervention performed under the supervision a psychotherapist, including doctoral or master's level

clinicians, psychiatric nurses, medical doctors, and students in these fields presumed to be trained in administering psychotherapy) and 2) report pre-treatment self-report measures of impulsive personality that map onto the UPPS-P framework (Lynam et al., 2007) and are at least two items long.

The UPPS-P (Lynam et al., 2007) provides a synthesis of impulsive personality measures, making the UPPS-P framework ideal for meta-analysis (e.g., Coskunpinar et al., 2013; Dir et al., 2014; VanderVeen et al., 2016). We included all measures in the analyses that 1) were self-report scales included in the original factor analysis performed to create the UPPS-P, or 2) after item inspection, appeared to tap into one of the UPPS-P traits. Two studies reported findings using an impulsive personality scale not identified a priori (TCU Adolescent Screening and Assessment Package; Knight et al., 2014; Difficulties in Emotion Regulation Scale, Gratz and Roemer, 2004); two raters independently reviewed the scales and classified the scale onto a specific UPPS-P trait (inter-rater reliability r=1).

An additional inclusion criterion for question one was the reporting of pre- and post-treatment measures of substance use, including frequency, rate, or a dichotomous outcome (e.g., abstinence vs. relapse). An additional inclusion criterion for question two was the reporting of a post-treatment self-report measure of impulsive personality that maps onto the UPPS-P framework (Lynam et al., 2007). Studies were excluded from both question one and two if impulsive personality traits were not assessed. Included studies were coded by one author, and a subset of included studies were coded by a second author (40%). Any discrepancies in coding were resolved prior to data analysis.

2.3 Meta-Analytic Method

For study aim one, Cohen's *d* was used to examine individual effect sizes for the relationship between pre-treatment impulsive personality and SUD treatment outcome for each UPPS-P trait. The term "treatment outcome" in the present meta-analysis was either 1) a dichotomous outcome of abstinence or relapse or 2) a continuous measure of substance use at the end of treatment, controlling for baseline level of substance use. Cohen's *d* was computed for each UPPS-P trait and then converted to bias-corrected Hedge's *g* using Comprehensive Meta-Analysis (CMA) Version 3.3.07 software. Effect sizes were coded so that positive values indicate that higher pre-treatment impulsive personality trait scores were associated with higher substance use scores (or relapse) post-treatment.

For study aim two, paired-samples *d* was used to examine individual effect sizes for the change in impulsive personality pre- to post- SUD psychotherapy for each UPPS-P trait (Borenstein et al., 2009). Raw means and standard deviations, correlations between pre- and post-scores, and sample sizes were entered into CMA, which computed paired samples *d* in accordance with formulas provided by Borenstein and colleagues (2009). For studies that did not report the correlation between pre- and post-impulsive personality scores, and that data were not obtained from authors, a correlation of $r=0.50$ was used (Borenstein et al., 2009). Paired-samples *d* was then converted to bias-corrected Hedge's *g* for each UPPS-P trait using CMA. Effect sizes were coded so that positive values indicated increased impulsive personality trait scores from pre- to post-treatment. For each study aim, a random-effects model was used to account for between study variance, in addition to within study error. Each effect size was weighted by its inverse variance weight. For exploratory analyses, fixed effect models were used for instances in which $k \leq 3$, as between study variance for small sample sizes is difficult to estimate, and often

computed as zero (Borenstein et al., 2009). We corrected for multiple effect sizes from the same sample by using the aggregate approach (i.e., taking the average effect size for each sample; Borenstein et al., 2009; Card, 2012); however, this approach reduces some variability in the effect sizes and assumes correlations between effect sizes (Card, 2012).

CMA was used to quantify 1) the effect size of the relationship between pre-treatment UPPS-P impulsive personality traits and SUD treatment outcome and 2) the effect size of the change in UPPS-P impulsive personality traits pre- to post- SUD psychotherapy.

A mean effect size was computed and a follow-up *z*-test was conducted using CMA to determine the significance of the mean effect size. For aim one, z-scores were interpreted using a two tailed significance test, and for aim 2, z-scores were interpreted using a one tailed significance test (H1: UPPS-P trait reduction pre to post treatment). Significance was determined on the $p < .05$ level for each study aim and effects were also interpreted in accordance with Cohen's (1992) guidelines for small (g=0.20), medium (g=0.50), and large (g=0.80) effects. A fail-safe N analysis was conducted for statistically significant effects to estimate the number of studies with null findings required to reduce the summary effect to non-significance. For each study aim, the I^2 index, computed using CMA, was used to quantify the degree of heterogeneity in effect sizes, or the variability in effect sizes caused by true heterogeneity between samples (Huedo-Medina et al., 2006).

3.0 Results

3.1 Study Aim One

Of the 40 studies meeting initial inclusion criteria (Figure 2), 14 studies were excluded because they did not measure substance use outcomes. Of the remaining 26 studies, 6 provided

all data on the relationship between impulsive personality and substance use treatment outcome. The authors of the remaining 20 studies (6 studies by the same author) were contacted for missing data, and 6 responded (total *k*=12). From the remaining 12 studies, 6 studies only had data on a broad measure of impulsive personality that did not tap into individual UPPS-P traits (e.g., BIS-11 total score). The final sample was composed of six studies. Four effects were reported for negative urgency and 5 effects were reported for lack of premeditation. No effects were reported for the remaining UPPS-P traits.

3.1.1 Lack of Premeditation (k=5). The total sample size for the relationship between pre-treatment lack of premeditation and SUD treatment outcome was N=537 (Mean=107.4, SD=39.16). Sample size, gender, age, and time to treatment follow-up were all approximately normally distributed (skewness -0.76 to 0.30; kurtosis -2.48 to -0.34). Mean percent female was 14.46% (SD=14.84%, range 0-33%), mean age was 35.15 (SD=7.71, range 26.1-44.98), and mean time to treatment follow-up was 237.25 days (SD=177.88, range 0-365 days).

The weighted mean effect size for the relationship between pre-treatment lack of premeditation and SUD treatment outcome (*k*=5) was medium, Hedges *g*=0.60 (*SE*=0.30; *95% CI* 0.01-1.20), and the effect was statistically significant, *z*=1.99, *p*=.05, indicating that lower pre-treatment lack of premeditation scores were associated with better SUD treatment outcomes (Fail-safe *N*=27). The I^2 Index of effect size heterogeneity was significant, I^2=82.52, *p*<.001, indicating that a significant proportion of variability in effect sizes was due to between study variation.

3.1.2 Negative Urgency (k=4). The total sample size for the relationship between pre-treatment negative urgency and SUD treatment outcome was N=435 (Mean=96, SD=34.94).

Sample size, gender, age, and time to treatment follow-up were all approximately normally distributed (skewness -0.85 to 1.30; kurtosis -1.29 to 1.21). Mean percent female was 13% (SD=17.93%, range 0-38%), mean age was 30.24 (SD=11.04, range 18.8-44.98), and mean time to treatment follow-up was 228.13 days (SD=177.88, range 0-365 days).

The weighted mean effect size for the relationship between pre-treatment negative urgency and SUD treatment outcome (k=4) was medium, Hedges g=0.55 (SE=0.17; *95% CI* 0.22-0.88), and the effect was statistically significant, z=3.30, p=.001, indicating that lower pre-treatment negative urgency scores were associated with better SUD treatment outcomes (Fail-safe N=19). The I^2 Index of effect size heterogeneity was significant, I^2=60.78, p=.05, indicating that a significant proportion of variability in effect sizes was due to between study variation.

3.2 Study Aim Two

Of the 40 studies meeting initial inclusion criteria (Figure 2), 26 studies were excluded because they did not measure post treatment impulsive personality. Of the remaining 14 studies, 6 provided all data on the relationship between pre and post treatment impulsive personality. The authors of the remaining 8 studies were contacted for missing data, but none responded; however, these studies were only missing pre and post treatment impulsive personality correlations, and correlations for these studies were estimated as r=0.50 (Borenstein et al., 2009). From the remaining 14 studies, 4 studies only had data on a broad measure of impulsive personality that did not tap into individual UPPS-P traits (e.g., BIS-11 total score). The final sample was composed of 10 studies, with 5 studies having estimated pre and post treatment impulsive personality correlations. Four effects were reported for sensation seeking, 7 effects

were reported for negative urgency, 8 effects were reported for lack of premeditation, 3 effects were reported for lack of perseverance, and 3 effects were reported for positive urgency.

The studies with estimated (r=0.50) versus reported (r=0.51, range 0.27 to 0.70) correlations between pre and post treatment impulsive personality did not differ on any study characteristics.

3.2.1 Sensation Seeking (k=4). The total sample size for the relationship between pre and post treatment sensation seeking was N=303 (Mean=75.75, SD=59.17). Sample size, gender, and age were all approximately normally distributed (skewness -1.03 to 1.73; kurtosis -2.14 to 2.10). Mean percent female was 47.07% (SD=11.20%, range 40-60%), and mean age was 33.08 (SD=10.72, range 18.3-44. The weighted mean effect size of the change in sensation seeking pre- to post- SUD treatment (k=4) was small, Hedges g=-0.10 (SE=0.05; *95% CI* -0.20-0.004), and the effect was statistically significant, z=-1.88, p=.02. The I^2 Index of effect size heterogeneity was non-significant, I^2=0, p=.64.

3.2.2 Lack of Premeditation (k=8). The total sample size for the relationship between pre and post lack of premeditation was N=507 (Mean=63.38, SD=86.20). Sample size, gender, and age were all approximately normally distributed (skewness -1.25 to 2.27; kurtosis 1.19 to 5.33). Mean percent female was 45.63% (SD=31.29%, range 17-100%), and mean age was 33.29 (SD=8.24, range 16.19-44. The weighted mean effect size of the change in lack of premeditation pre- to post- SUD treatment (k = 8) was small, Hedges g=-0.16 (SE=0.14; *95% CI* -0.44-0.12), and the effect was not statistically significant, z=-1.12, p=0.12. The I^2 Index of effect size heterogeneity was significant, I^2=86.53, p<.001, indicating that a significant proportion of variability in effect sizes was due to between study variation.

3.2.3 Negative Urgency (k=7). The total sample size for the relationship between pre and post treatment negative urgency was N=466 (Mean=66.57, SD=92.60). Sample size, gender, and age were all approximately normally distributed (skewness -1.56 to 2.10; kurtosis 1.33 to 4.46). Mean percent female was 51.423% (SD=31.19%, range 17-100%), and mean age was 33.89 (SD=8.70, range 16.19-44). The weighted mean effect size of the change in negative urgency pre- to post- SUD treatment (k = 7) was small, Hedges g=-0.25 (SE = 0.14; *95% CI* -0.53-0.03), and the effect was statistically significant, z=-1.75, p=.03. The I^2 Index of effect size heterogeneity was significant, I^2=82.58, p<.001, indicating that a significant proportion of variability in effect sizes was due to between study variation.

3.2.4 Lack of Perseverance (k=3). The total sample size for the relationship between pre and post treatment lack of perseverance was N=156 (Mean=96, SD=34.94). Sample size and age (gender not computed, k=2 reported) were approximately normally distributed (skewness .90 and 1.73, respectively; kurtosis not computed). Mean percent female was 50.20% (SD=13.86%, range 40-60%), and mean age was 38 (SD=5.20, range 35-44). The weighted mean effect size of the change in lack of perseverance pre- to post- SUD treatment (k = 3) was small, Hedges g=-0.23 (SE=0.17; *95% CI* -0.57-0.11), and the effect approached statistical significance, z=-1.33, p=.08. The I^2 Index of effect size heterogeneity was significant, I^2=74.87, p=.01, indicating that a significant proportion of variability in effect sizes was due to between study variation.

3.2.5 Positive Urgency (k=3). The total sample size for the relationship between pre and post treatment positive urgency was N=321 (Mean=135.33, SD=114.89). Sample size and age (gender not computed, k=2 reported) were approximately normally distributed (skewness 1.28 and -1.73, respectively; kurtosis not computed). Mean percent female was 50.20% (SD=13.86%,

range 40-60%), and mean age was 28.73 (SD=10.86, range 16.19-35). The weighted mean effect size of the change in positive urgency pre- to post- SUD treatment (k = 3) was small, Hedges g=0.04 (SE=0.05; *95% CI* -0.05-0.17), and the effect was not statistically significant, z=0.47, p=.30. The I^2 Index of effect size heterogeneity was non-significant, I^2=21.74, p=0.28.

4. Discussion

Research has highlighted impulsive personality as an important risk factor for substance use risk. However, limited research has extended these findings to clinical practice. First, present meta-analytic findings suggest that higher lack of premeditation and negative urgency are related to poorer SUD treatment outcomes. A significant amount of literature supports that negative urgency and lack of premeditation are related to substance use risk (e.g., Coskunpinar et al., 2013; VanderVeen et al., 2016), and further, may developmentally precede substance use (Littlefield et al., 2012; Guller et al., 2015). Thus, it is not surprising that the relationship between these traits and substance use extends to the treatment process as well, with higher levels of these traits potentially impeding substance use change.

Findings suggest there is a need to assess negative urgency and lack of premeditation in SUD psychotherapy, particularly prior to treatment planning. Well established research supports the assessment and tracking of other factors that may hamper substance use change in treatment, including motivation for change (e.g., Annis et al., 1996) and coping skills (e.g., Rohsenow et al., 2000), which are then integrated into treatment planning and goal setting. Thus, the cumulative research findings we reviewed suggest that negative urgency and lack of premeditation should be assessed as factors that may affect SUD treatment outcome and should

be integrated into treatment planning. We propose that this would improve case conceptualization, treatment planning, and treatment outcomes.

Second, present findings indicate that negative urgency and sensation seeking decrease during SUD treatment; however, importantly, these decreases are quite small. Although it could not be assessed in the current study, it is possible that the small nature of reduction in impulsive personality traits in SUD psychotherapy might explain documented poor treatment outcomes. This suggests viability of the theory that at the end of treatment, even if substance use is decreased, clients may be left with impulsive tendencies that impart risk for subsequent substance use or relapse (dotted line in Figure 1). Of course, due to the meta-analytic method of the current study and the nature of existing studies in this area of research, there were no comparison groups, so it is not clear that these found reductions in negative urgency and sensation seeking are due to something related specifically to SUD psychotherapy. These traits tend to be quite stable without intervention across similar time periods as were used in many of the reviewed studies (e.g., Cyders and Smith, 2007; Cyders et al., 2009), suggesting that these changes could be related to treatment intervention. Regardless of the cause of these changes, they are quite small. If reducing negative urgency and sensation seeking would help SUD treatment, our review suggests that current SUD psychotherapies are not reducing these tendencies well, which might limit treatment outcomes.

It is important to note that, in most cases, research examining changes in impulsive personality across SUD treatment is likely conducted on the assumption that reducing impulsive personality is important for better treatment outcomes. Some research indicates that decreases in impulsive personality are related to decreases in alcohol use one year later (Blonigen et al., 2011;

Blonigen et al., 2013), providing promising support for impulsive personality as a mechanism of substance use change, although, not surprisingly, these same decreases in impulsive personality were also related to changes in self-efficacy to resist drinking, emotional coping, and social support (Blonigen et al., 2011; Blonigen et al., 2013). At the same time, whether or not impulsive personality is related to changes in substance use following SUD treatment, high levels of impulsive personality are problematic for a host of risk taking behaviors (e.g., Coskunipar et al., 2013; Dir et al., 2014; VanderVeen et al., 2016). Impulsive personality traits have been well studied as a transdiagnostic phenotype, serving as important predictors and risk factors for eating disorders (e.g., Pearson et al., 2015), gambling disorders (e.g., Savvidou et al., 2017), non-suicidal self-injury and suicidality, aggression, antisocial personality disorder, borderline personality disorder (Berg et al., 2015), and sexual risk taking (Dir et al., 2014), to name a few. Negative urgency in particular is a notable trait of clinical risk that is a prime point of intervention (e.g., Cyders et al., in press). Because impulsive personality imparts risk for a wide range of addictive problems, targeting and reducing impulsive personality could benefit a multitude of clinical disorders, including gambling disorders, Attention Deficit/Hyperactivity Disorder, and Borderline Personality Disorder, among others, many of which are comorbid with SUD. This is in contrast to many current treatment models that focus on more specific cognitions or beliefs related to each behavior type.

Reductions in impulsive personality are related to reductions in substance use across the lifespan, making it plausible that such changes in impulsive personality may be a mechanism of substance use change in SUD treatment. The phenomenon of "maturing out" (Winick, 1962) of substance use posits that as individuals age, particularly into their 20's and 30's, substance use

decreases, with such substance use decreases attributable to shifting role changes, such as entering the workforce (Gotham et al., 1997). Findings indicate that role changes are not the sole mechanisms by which substance use is reduced and that decreases in impulsive personality longitudinally predict decreases in substance use, above and beyond role changes (e.g., marriage, having children; Littlefield et al., 2009). Further, as individuals age into their 20's, role changes become less predictive of changes in substance use and personality traits (e.g., disinhibition) become more predictive of substance use change (Lee et al., 2015). Thus, as impulsive personality traits persist into adulthood, so does substance use.

We propose that the current state of the literature suggests that being more purposeful in intervening on impulsive personality could improve SUD treatment. Although specific impulsive personality targeted interventions based on the UPPS-P model have not been largely investigated, there are recommendations for interventions and some emerging work suggests success of this approach. For example, strategies for intervening upon negative urgency may include conducting functional analyses of behavioral patterns in line with acting rashly in response to negative emotion, relaxation training, and distress tolerance (Zapolski et al., 2010a). Further, recent findings from an experimental intervention study, conducted in a small sample of African American women, showed significant reductions in negative urgency pre to post treatment via an emotion modulation intervention (e.g., teaching adaptive emotion regulation strategies, identifying distraction strategies; Weiss et al., 2015). Additionally, clinicians could target lack of premeditation through organization and cognitive remediation training, and teach clients how to break tasks down into manageable steps. What is most notable about potential means of intervening upon impulsive personality is their relative ease of implementation and the

potential for broad effects on a wide range of risk-taking behaviors and disorders. Such therapeutic techniques have been feasibly incorporated into school-based treatment (Zapolski and Smith, 2016), and thus, can likely be easily incorporated into other treatment settings.

Given the large body of research establishing impulsive personality as a risk factor for substance use (e.g., Littlefield et al., 2012; Guller et al., 2015) and related disorders (e.g., Cyders et al., in press), it is somewhat surprising that there are limited data extending such findings to clinical practice in a systematic way. Many of the reviewed studies did not intend to study or change impulsive personality throughout treatment and only assessed impulsive personality as a way to characterize the participants. The literature in this area is ever expanding; thus, it may have been previously premature to extend findings to clinical practice. However, given increasing SUD prevalence and related deaths in the United States and what we feel is adequate feasibility evidence for targeting impulsive personality in treatment, we recommend a purposeful empirical approach to develop and test the effectiveness of impulsive personality targeted treatments in reducing substance use and related factors. Further, given the transdiagnostic role of impulsive personality, interventions targeting impulsivity personality have the potential for widespread benefits across multiple clinical problems and disorders. The UPPS-P model of impulsive personality is a tool that can be easily administered in clinical practice and has been validated in short form (Cyders et al., 2014), multiple languages (e.g., Kämpfe and Mitte, 2009; Verdejo-Garcia et al., 2010; Billieux et al., 2012), and child and adolescent samples (d'Acremont and Van der Linden, 2005; Zapolski et al., 2010b). Further, the UPPS-P is likely less subject to self-report bias, particularly social desirability, than measures of substance use. Overall, we

suggest that the measurement and targeting of impulsive personality traits into SUD treatment has strong potential to improve clinical outcomes.

Although the present findings add greatly to the substance use treatment and impulsive personality literature, there are some limitations to discuss. First, it is possible that, due to factors such as limited sample size and the "file drawer problem", the true effect was not detected. We were surprised to find that so few studies had examined the role of impulsive personality in SUD psychotherapy and that many of these studies had quite small sample sizes. We see our quantitative review as important in synthesizing this work in order to better determine how impulsive personality might influence and be influenced by SUD psychotherapy. This review allows for more robust findings than any of these previous studies in isolation and suggests future work in this area. Also, findings may not generalize to demographics not examined by current literature. One limitation that may impact the interpretation of the relationship between pre-treatment impulsive personality and SUD treatment outcomes is that the substance use outcome measures varied between studies, including abstinence vs. relapse and drug use severity, and the present study was underpowered to examine substance use outcome as a moderator. We were also unable to examine time to treatment follow-up as a potential moderator, which should be done in the future since as time progresses following substance use treatment, so does the likelihood of substance use relapse (or increases in substance use) (e.g., Brecht and Herbeck, 2014). In addition, due to the nature of the meta-analytic method and available studies, there were no comparison groups, thus limiting any assumptions regarding if observed changes in impulsive personality traits was due specifically to treatment. Previously reported changes in impulsive personality traits in absence of treatment (e.g., Cyders, et al.,

2009) are smaller than reported here, suggesting that treatment could be reducing these tendencies. Regardless of the reason for the change (whether due to treatment or natural fluctuations), the changes were quite small. Another limitation that affects the interpretation of findings is the operationalization of substance use treatment. We only included studies that utilized professional-led SUD psychotherapy treatment, thus excluding pharmacological or peer-led treatments. The present meta-analysis did not examine treatment completion as a study outcome, which could be an important mechanism by which impulsivity decreases treatment success (e.g., Loree et al., 2015). Additionally, the present study did not examine the relationship between behavioral impulsivity (e.g., Delay Discounting) and substance use treatment outcomes. Evidence suggests behavioral impulsivity is related to substance use treatment outcomes (e.g., Stevens et al., 2014); however, impulsive personality traits have a small relationship with behavioral measures of impulsivity (r = 0.10), and thus likely represents a unique construct. Although clarification of the relationship between behavioral impulsivity and SUD treatment outcome is likely important, it is beyond the focus of the present meta-analysis.

5.0 Conclusions

In conclusion, the current findings suggest that 1) lack of premeditation and negative urgency are related to poorer SUD psychotherapy treatment outcomes and 2) although negative urgency and sensation seeking are decreasing during SUD psychotherapy, the magnitude of the change is quite small, which could increase risk for relapse. Overall, we suggest that the measurement and targeting of impulsive personality traits in psychotherapy has strong potential to improve clinical outcomes across SUDs and a wide range of clinical problems and disorders.

Author Disclosures

Role of Funding Sources

The preparation of this manuscript was supported in part by an NIAAA F31 grant to Alexandra Hershberger (F31 AA024682) under the mentorship of Melissa A. Cyders. The NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or decision to submit the paper for publication.

Contributions

Author Alexandra Hershberger conducted the literature search, data-analysis, coded articles, and compiled the manuscript. Author Miji Um coded articles and aided in compiling and editing the manuscript. Author Melissa Cyders aided in study design and manuscript editing. All authors have approved the final article.

Conflicts of interest

The authors have no conflicts of interest to declare.

Acknowledgments

The authors would like to acknowledge Tamika Zapolski and Adam Hirsh for their helpful comments on an earlier draft of this manuscript. The authors would like to thank the authors that provided unpublished data for the present meta-analysis: Eun-Young Mun & Dolores Cimini, Michael G. MacLean, Jessica K. Bentzley, Erica N. Peters, Priscila Dib Goncalves, and Sabine Löber. I would also like to thank authors that provided additional methodological information for the studies used in the present meta-analysis: Cüneyt Evren, Marcin Wojnar, Andrew Littlefield, Sandra Müller, Alessandra Reis, and Harilaos Papachristou.

References

Aklin, W. M., Tull, M. T., Kahler, C. W., Lejuez, C. W., 2009. Risk-taking propensity changes throughout the course of residential substance abuse treatment. Pers. Ind. Dif. 46, 454-459.

Amaro, H., Magno-Gatmaytan, C., Meléndez, M., Cortés, D. E., Arevalo, S., Margolin, A., 2010. Addiction treatment intervention: An uncontrolled prospective pilot study of spiritual self-schema therapy with Latina women. Subst. Abus. 31, 117-125.

Annis, H. M., Schober, R., Kelly, E., 1996. Matching addiction outpatient counseling to client readiness for change: The role of structured relapse prevention counseling. Exp. Clin. Psychopharm. 4, 37.

Axelrod, S. R., Perepletchikova, F., Holtzman, K., Sinha, R., 2011. Emotion regulation and substance use frequency in women with substance dependence and borderline personality disorder receiving dialectical behavior therapy. Am. J. Drug Alcohol Ab. 37, 37-42.

Beck, J. S., 2011. Cognitive behavior therapy: Basics and beyond. Guilford Press. New York, NY.

Bentzley, J. P., Tomko, R. L., Gray, K. M., 2016. Low pretreatment impulsivity and high medication adherence increase the odds of abstinence in a trial of N-Acetylcysteine in adolescents with cannabis use disorder. J. Subst. Abuse Treat. 63, 72-77.

Berg, J. M., Latzman, R. D., Bliwise, N. G., Lilienfeld, S. O., 2015. Parsing the heterogeneity of impulsivity: A meta-analytic review of the behavioral implications of the UPPS for psychopathology. Psychol. Assess. 27, 1129-1146.

Billieux, J., Rochat, L., Ceschi, G., Carré, A., Offerlin-Meyer, I., Defeldre, A. C., Khazaal, Y., Besche-Richard, C., Van der Linden, M., 2012. Validation of a short French version of the UPPS-P Impulsive Behavior Scale. Compr. Psychiatry 53, 609-615.

Blonigen, D. M., Timko, C., Finney, J. W., Moos, B. S., Moos, R. H., 2011. Alcoholics Anonymous attendance, decreases in impulsivity and drinking and psychosocial outcomes over 16 years: Moderated mediation from a developmental perspective. Addiction 16, 2167-2177.

Blonigen, D. M., Timko, C., Moos, R. H., 2013. Alcoholics Anonymous and reduced impulsivity: A novel mechanism of change. Subst. Abus. 34, 4-12.

Borenstein, M., Hedges, L. V., Higgins, J., Rothstein, H. R., 2009. Introduction to Meta-analysis. John Wiley and Sons, Ltd. Chichester, U.K.

Brecht, M. L., Herbeck, D., 2014. Time to relapse following treatment for methamphetamine use: A long-term perspective on patterns and predictors. Drug Alcohol Depend. 139, 18-25.

Card, N., 2012. Applied meta-analysis for social science research. Guilford Press. New York, NY.

Centers for Disease Control and Prevention, 2013. Alcohol Related Disease Impact (ARDI) application, Retrieved April 1, 2016 from www.cdc.gov/ARDI.

Centers for Disease Control and Prevention, 2015. Overdose death rates, Retrieved April 1, 2016 from https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates.

Cimini, M. D., Martens, M. P., Larimer, M. E., Kilmer, J. R., Neighbors, C., Monserrat, J. M., 2009. Assessing the effectiveness of peer-facilitated interventions addressing high-risk drinking among judicially mandated college students. J. Stud. Alcohol Drugs 16 , 57-66.

Cohen, J., 1992. A power primer. Psychol. Bull. 112, 155-159.

Coskunpinar, A., Dir, A. L., Cyders, M. A., 2013. Multidimensionality in impulsivity and alcohol Use: A meta-analysis using the UPPS model of impulsivity. Alcohol Clin. Exp. Res., 37, 1441-1450.

Crawley, R. D., 2015. An examination of cognitive changes among youth in community-based and juvenile justice secure residential treatment. (Doctoral Dissertation, Texas Christian University).

Cyders, M. A., Coskunpinar, A., 2011. Measurement of constructs using self-report and behavioral lab tasks: Is there overlap in nomothetic span and construct representation for impulsivity?. Clin. Psychol. Rev. 31, 965-982.

Cyders, M. A., Smith, G. T., 2007. Mood-based rash action and its components: Positive and negative urgency. Pers. Ind. Dif. 43, 839-850.

Cyders, M. A., Flory, K., Rainer, S., Smith, G. T., 2009. The role of personality dispositions to risky behavior in predicting first-year college drinking. Addiction 104, 193-202.

Cyders, M. A., Littlefield, A. K., Coffey, S., Karyadi, K. A., 2014. Examination of a short English version of the UPPS-P Impulsive Behavior Scale. Addict. Behav. 39, 1372-1376.

Cyders, M. A., Coskunpinar, A., VanderVeen, J. D., in press. Urgency – a common transdiagnostic endophenotype for maladaptive risk-taking. Invited chapter in press in V.

Zeigler-Hill and D.Marcus (Eds.), The Dark Side of Personality. American Psychological Association

d'Acremont, M., Van der Linden, M., 2005. Adolescent impulsivity: Findings from a community sample. J. Youth Adolesc. 34, 427-435.

Dib-Goncalves, Priscila, Mariella Ometto, Antoine Bechara, André Malbergier, Ricardo Amaral, Sergio Nicastri, Paula A. Martins, Beraldo, L., dos Santos, B., Fuentes, D., Andrede A.G., Bussato, G.F., Cunha, P.J., 2014. Motivational Interviewing combined with chess accelerates improvement in executive functions in cocaine dependent patients: A one-month prospective study. Drug Alcohol Depend. 141, 79-84.

Dir, A. L., Coskunpinar, A., Cyders, M. A., 2014. A meta-analytic review of the relationship between adolescent risky sexual behavior and impulsivity across gender, age, and race. Clin. Psychol. Rev. 34, 551-562.

Evren, C., Durkaya, M., Evren, B., Dalbudak, E., Cetin, R., 2012. Relationship of relapse with impulsivity, novelty seeking and craving in male alcohol-dependent inpatients. Drug Alcohol Rev. 31, 81-90.

Evren, C., Yılmaz, A., Can, Y., Bozkurt, M., Evren, B., Umut, G., 2014. Severity of impulsivity and aggression at a 12-month follow-up among male heroin dependent patients. Bull. Clin. Psychopharmacol. 24, 158-67.

Gotham, H. J., Sher, K. J., Wood, P. K., 1997. Predicting stability and change in frequency of intoxication from the college years to beyond: individual-difference and role transition variables. J. Abnorm. Psychol., 106(4), 619.

Guller, L., Zapolski, T. C., Smith, G. T., 2015. Personality measured in elementary school predicts middle school addictive behavior involvement. J. Psychopathol. Behav. Assess. 37, 523-532.

Huedo-Medina, T. B., Sanchez-Meca, J., Marin-Martinez, F., Botella, J., 2006. Assessing heterogeneity in meta-analysis: Q Statistic of I2 Index? Center for Health, Intervention, and Prevention (CHIP) Documents.

Irwin, P. P., Stoner, S. B., 1991. Women's chemical dependency treatment program: A pilot study. Alcohol T. Q. 8, 123-130.

Jones, S. H., Barrowclough, C., Allott, R., Day, C., Earnshaw, P., Wilson, I., 2011. Integrated motivational interviewing and cognitive–behavioural therapy for bipolar disorder with comorbid substance use. Clin. Psychol. Psychother. 18, 426-437.

Kämpfe, N., Mitte, K., 2009. A German validation of the UPPS impulsive behavior scale: Further evidence for a four-dimensional model of impulsivity. Eur J. Psychol. Assess. 25, 252-259.

Kazemi, D. M., Levine, M. J., Dmochowski, J., Angbing, I., Shou, Q., 2014. Personality risk factors and readiness to change in mandated and voluntary college students enrolled in an alcohol intervention program. Subst. Use Misuse 49, 154-165.

Kiluk, B. D., Nich, C., Babuscio, T., Carroll, K. M., 2010. Quality versus quantity: Acquisition of coping skills following computerized cognitive–behavioral therapy for substance use disorders. Addiction 105, 2120-2127.

Lee, E. B., An, W., Levin, M. E., Twohig, M. P., 2015. An initial meta-analysis of Acceptance and Commitment Therapy for treating substance use disorders. Drug Alcohol Depend. 155, 1551-1557.

Littlefield, A. K., Sher, K. J., Wood, P. K., 2009. Is "maturing out" of problematic alcohol involvement related to personality change? J. Abnorm. Psychol. 118, 360–374.

Littlefield, A. K., Sher, K. J., 2010. The multiple, distinct ways that personality contributes to alcohol use disorders. Soc. Personal. Psychol. Compass 4, 767-782.

Littlefield, A. K., Vergés, A., Wood, P. K., Sher, K. J., 2012. Transactional models between personality and alcohol involvement: A further examination. J. Abnorm. Psychol. 121, 778.

Littlefield, A. K., Stevens, A. K., Cunningham, S., Jones, R. E., King, K. M., Schumacher, J. A., Coffey, S. F., 2015. Stability and change in multi-method measures of impulsivity across residential addictions treatment. Addict. Behav. 42, 126-129.

Loree, A. M., Lundahl, L. H., Ledgerwood, D. M., 2015. Impulsivity as a predictor of treatment outcome in substance use disorders: Review and synthesis. Drug Alcohol Rev. 34, 119-134.

Lynam, D., Smith, G. T., Cyders, M. A., Fischer, S., Whiteside, S. A., 2007. The UPPS-P: A multidimensional measure of risk for impulsive behavior. Unpublished technical report.

Maddox, J., 2011. The effects of mindfulness-based relapse prevention on impulsivity and mindfulness (Doctoral dissertation, Institute of Transpersonal Psychology).

Magill, M., Kiluk, B. D., McCrady, B. S., Tonigan, J. S., Longabaugh, R., 2015. Active ingredients of treatment and client mechanisms of change in behavioral treatments for alcohol use disorders: Progress 10 years later. Alcohol. Clin. Exp. Res. 39, 1852-1862.

McHugh, R. K., Hearon, B. A., Otto, M. W., 2010. Cognitive behavioral therapy for substance use disorders. Psychiatr. Clin. North Am. 33, 511-525.

Müller, S. E., Weijers, H. G., Böning, J., Wiesbeck, G. A., 2008. Personality traits predict treatment outcome in alcohol-dependent patients. Neuropsychobiol. 57, 159-164.

Papachristou, H., Nederkoorn, C., Giesen, J. C., Jansen, A., 2014. Cue reactivity during treatment, and not impulsivity, predicts an initial lapse after treatment in alcohol use disorders. Addict. Behav. 39, 737-739.

Pearson, C. M., Wonderlich, S. A., Smith, G. T., 2015. A risk and maintenance model for bulimia nervosa: From impulsive action to compulsive behavior. Psychol. Rev. 122, 516.

Peters, E. N., Petry, N. M., LaPaglia, D. M., Reynolds, B., Carroll, K. M., 2013. Delay discounting in adults receiving treatment for marijuana dependence. Exp. Clin. Psychopharm. 21, 46.

Piedmont, R. L., Ciarrocchi, J. W., 1999. The utility of the Revised NEO Personality Inventory in an outpatient, drug rehabilitation context. Psychol. Addict. Behav. 13, 213.

Rohsenow, D. J., Monti, P. M., Martin, R. A., Michalec, E., Abrams, D. B., 2000. Brief coping skills treatment for cocaine abuse: 12-month substance use outcomes. J. Consult. Clin. Psychol. 68, 515-520.

Savvidou, L. G., Fagundo, A. B., Fernández-Aranda, F., Granero, R., Claes, L., Mallorquí-Baqué, N., ... del Pino-Gutiérrez, A., 2017. Is gambling disorder associated with

impulsivity traits measured by the UPPS-P and is this association moderated by sex and age?. Compr. Psychiatry 72, 106-113.

Sharma, L., Markon, K. E., Clark, L. A., 2014. Toward a theory of distinct types of "impulsive" behaviors: A meta-analysis of self-report and behavioral measures. Psychol. Bull. 140, 374.

Staiger, P. K., Dawe, S., Richardson, B., Hall, K., Kambouropoulos, N., 2014. Modifying the risk associated with an impulsive temperament: A prospective study of drug dependence treatment. Addict. Behav. 39, 1676-1681.

Stevens, A. K., Littlefield, A. K., Blanchard, B. E., Talley, A. E., Brown, J. L., 2016. Does drinking refusal self-efficacy mediate the impulsivity–problematic alcohol use relation?. Addict. Behav. 53, 181-186.

Stevens, L., Verdejo-García, A., Goudriaan, A. E., Roeyers, H., Dom, G., Vanderplasschen, W., 2014. Impulsivity as a vulnerability factor for poor addiction treatment outcomes: A review of neurocognitive findings among individuals with substance use disorders. J. Subst. Abuse Treat. 47, 58-72.

Substance Abuse and Mental Health Services Administration, 2014. National Survey of Substance Abuse Treatment Services (N-SSATS): 2013, page 53. Data on Substance Abuse Treatment Facilities. BHSIS Series S-73, HHS Publication No. (SMA) 14-4890. Substance Abuse and Mental Health Services Administration. Rockville, MD.

VanderVeen, J. D., Hershberger, A. R., Cyders, M. A., 2016. UPPS-P model impulsivity and marijuana use behaviors in adolescents: A meta-analysis. Drug Alcohol Depend. 168, 181-190.

Verdejo-García, A., Lozano, Ó., Moya, M., Alcázar, M. Á., Pérez-García, M., 2010. Psychometric properties of a Spanish version of the UPPS–P impulsive behavior scale: Reliability, validity and association with trait and cognitive impulsivity. J. Pers. Assess. 92, 70-77.

Weiss, N. H., Tull, M. T., Davis, L. T., Searcy, J., Williams, I., Gratz, K. L., 2015. A preliminary experimental investigation of emotion dysregulation and impulsivity in risky behaviours. Behav. Change 32, 127-142.

White, 2012. Recovery/emission from Substance Use Disorders: An analysis of reported outcomes in 415 scientific reports, 1868-2011 (Substance Abuse and Mental Health Services Administration 5 UD1 TI013593-0). Philadelphia Department of Behavioral Health and Intellectual Disability Services. Philadelphia, PA.

Winick, C., 1962. Maturing out of narcotic addiction. Bull. Narc. 14, 1-7.

Witkiewitz, K., Donovan, D. M., Hartzler, B., 2012. Drink refusal training as part of a combined behavioral intervention: Effectiveness and mechanisms of change. J. Consult. Clin. Psychol. 80, 440.

Zapolski, T. C., Settles, R. E., Cyders, M. A., Smith, G. T., 2010a. Borderline personality disorder, bulimia nervosa, antisocial personality disorder, ADHD, substance use: Common threads, common treatment needs, and the nature of impulsivity. Independ. Pract. 30, 20.

Zapolski, T. C., Stairs, A. M., Settles, R. F., Combs, J. L., Smith, G. T., 2010b. The measurement of dispositions to rash action in children. Assessment 17, 116-125.

Zapolski, T. C., Smith, G. T., 2016. Pilot study implementing a brief DBT skills program in schools to reduce health risk behaviors among early adolescents. J. Sch. Nurs. 1059840516673188.

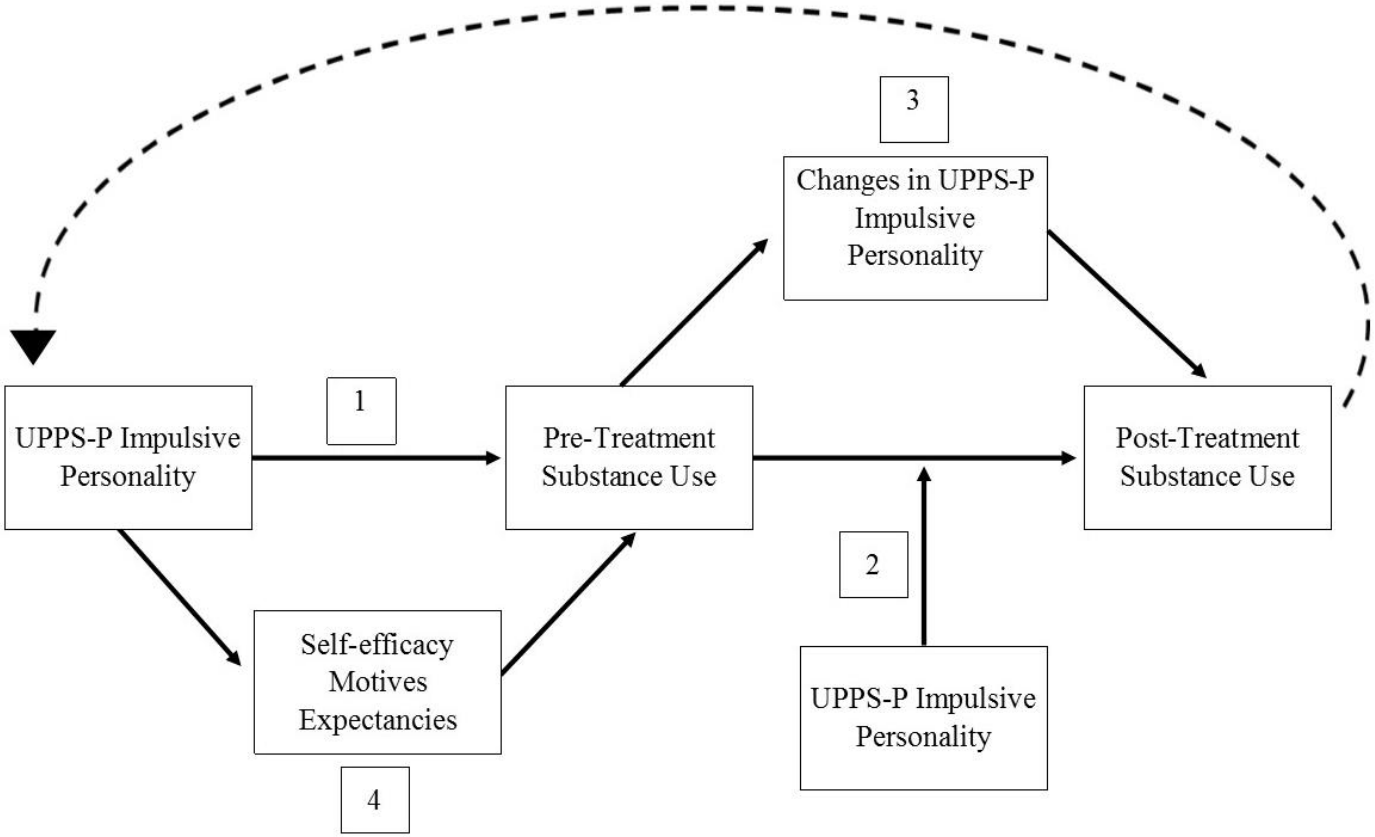

Figure 1.

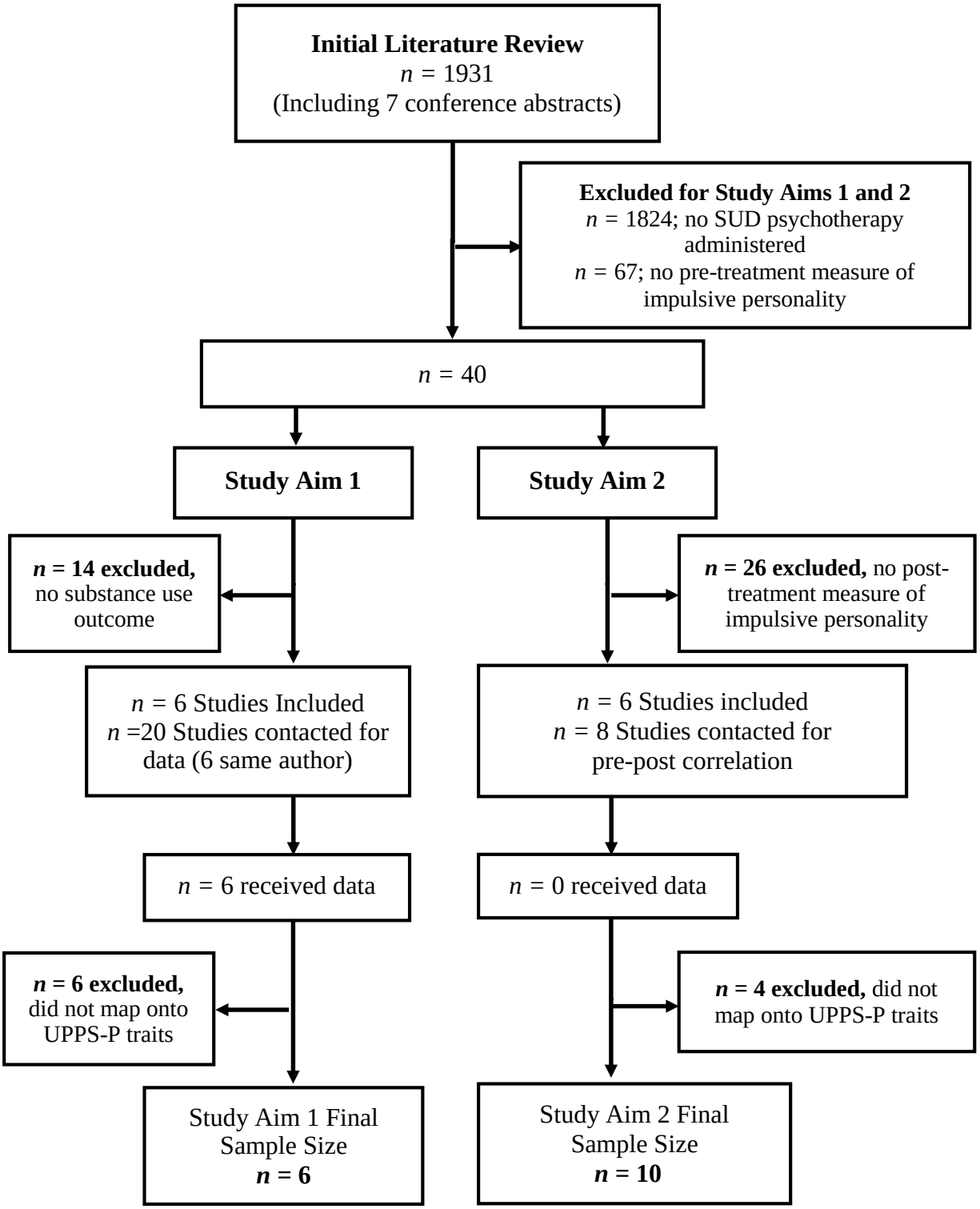

Figure 2.

Figure Legends

Figure 1: 1) High UPPS-P impulsive personality imparts risk for pre-treatment substance use; 2) UPPS-P impulsive personality may also serve as a risk factor for poor treatment outcomes, with individuals higher on these traits showing less substance use change pre- to post-treatment; 3) changes in UPPS-P impulsive personality could be one way by which substance use changes pre- to post-treatment, with those showing the greatest reductions in UPPS-P traits also most likely to show reductions in substance use pre- to post-treatment; and 4) the risk of UPPS-P impulsive personality of pre-treatment substance use occurs through mechanisms, such as self-efficacy, motives, and expectancies. Dotted line: Post-treatment, individuals may be left with impulsive tendencies that impart risk for subsequent substance use or relapse.

Figure 2: Study Inclusion and Exclusion.

Table 1.

Study aim one: Individual study characteristics

Study	N	Mean Age (SD)	% Female	Sample type	Diagnosis of Sample	Treatment Administered	Substance Use Measure	Impulsive Personality Measure	UPPS-P Trait(s) Assessed
Cimini et al., 2009†	137	18.8 (0.79)	38	Mandated College Students	Alcohol Violation	1) Brief MI 2) Brief MI and peer theater*	1) RAPI 2) Drinks per week*	UPPS-P negative urgency	NUR
Evren et al., 2012	102	44.98 (9.07)	0	Adult Inpatient	AUD	CBT-based program	Abstinent versus Slip/Relapse	BIS-11	NUR, PRE
Evren et al., 2014	52	31.07 (8.08)	0	Adult Inpatient	OUD	CBT plus buprenorphine naloxone combination	Abstinent versus Slip/Relapse	BIS-11	NUR, PRE
Müller et al., 2008	146	41 (8.3)	25.34	Adult Inpatient	AUD	Psychosocial treatment program with motivational counseling	Abstinent versus Slip/Relapse	I7	PRE
Peters et al., 2013	93	26.1 (7.5)	14	Adult Outpatient	CUD	1) CBT, 2) CBT and CM for adherence, 3) CM for abstinence, 4) CBT and CM for abstinence*	Percent days abstinent	BIS-11	NUR, PRE
Staiger et al., 2014	144	32.5 (6.8)	33	Adult Inpatient	Poly SUD	Emotion regulation, interpersonal skills, mindfulness	Drug use severity	I7	PRE

Note. CUD = Cannabis Use Disorder; AUD = Alcohol Use Disorder; OUD = Opiate Use Disorder; CM = Contingency Management; MI = Motivational Interviewing; CBT = Cognitive Behavioral Therapy; RAPI = Rutgers Alcohol Problem Index; BIS = Barrett Impulsiveness Scale-11; I7 = Eysenck's Impulsivity Scale; Length of treatment represents estimate based on average days per study; NUR= Negative Urgency; PRE= Lack of Premeditation; † Age and gender based on N = 458; ††Age and gender based on N = 94

Table 2.

Study aim two: Individual sample characteristics

Study	N	Mean Age (SD)	% Female	Sample type	Diagnosis of Sample	Treatment Administered	Impulsive Personality Measure	UPPS-P Trait(s) Assessed
Aklin et al., 2009	41	.38 (10.3)	17	Adult Inpatients	SUD	AA/NA, RP, Functional Analysis	I7 Impulsiveness	PRE
Axelrod et al., 2011†	15	38	100	Adult Outpatient	SUD and BPD	DBT	DERS Impulse Control Scale	NUR
Crawley, 2015	264	16.19	0	Detained and Inpatient Adolescents	SUD	CBT treatment	TCU-ASAP	NUR, PRE, PUR
Dib-Goncalves et al., 2014 [a]	26	31.9 (6.6)	16	Adult Inpatients	Cocaine UD	1. MI 2. MI and chess practice	BIS-11	NUR, PRE
Irwin and Stoner, 1991	15	29.1 (8.8)	100	Adult Inpatient	SUD	AA/NA, individual and group treatment, skill building	Personality Research Form	PRE
Jones et al., 2011[a]	5	37.6 (3.4)	40	Adult Outpatient	AUD and/or CUD + Bipolar Disorder	MI and CBT	BIS-11	NUR, PRE
Kazemi et al., 2014	147	18.3 (.5)	41	Mandated College Students	Alcohol Violation	MI	SURPS	SS
Littlefield et al., 2015[a]	43	35	60	Adult Inpatient	SUD	DBT, MI, AA	UPPS-P	NUR, PRE, PER, PUR, SS
Maddox, 2011	14	44 (9.4)	NP	Adult Outpatient	SUD	Mindfulness-based RP	UPPS-P	NUR, PRE, PER, PUR, SS
Piedmont and Ciarrocchi, 1999[a]	99	35	40	Adult Outpatient	SUD	Skill building, individual and group counseling, AA/NA	NEO-PI-R	NUR, PRE, PER, SS

Note. AUD = Alcohol Use Disorder; CUD = Cannabis Use Disorder; BPD = Borderline Personality Disorder; MI = Motivational Interviewing; CBT = Cognitive Behavioral Therapy; RP = Relapse Prevention; AA/NA = Alcoholics Anonymous/Narcotics Anonymous; DBT = Dialectical Behavioral Therapy; BIS = Barrett Impulsiveness Scale 11; I7 = Eysenck's Impulsivity Scale; DERS = Difficulties in Emotion Regulation; SURPS = Substance Use Risk Profile Scale; Length of treatment represents estimate based on average days per study; NUR= Negative Urgency; PRE= Lack of Premeditation; PER = Lack of Perseverance; SS = Sensation Seeking; PUR = Positive Urgency [a] Pre/post correlations reported for impulsive personality; † Descriptive statistics based on sample of N = 27